



**STRATEGIC AIRLIFT AND
THE OBJECTIVE FORCE BRIGADE**

GRADUATE RESEARCH PROJECT

Jeffrey J. Waters, Major, USAF

AFIT/GMO/ENS/03E-15

**DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY**

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

The views expressed in this paper are those of the author and do not reflect the official policy or position of the United States Air Force, Department of Defense, or the United States Government.

STRATEGIC AIRLIFT AND
THE OBJECTIVE FORCE BRIGADE

GRADUATE RESEARCH PROJECT

Presented to the Faculty

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

in Partial Fulfillment of the Requirements for the

Degree of Master of Air Mobility

Jeffrey J. Waters

Major, USAF

June 2003

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

Acknowledgments

I would like to thank my wife, and my children, for their patience, love and encouragement during this project.

I would also like to extend a special thanks to Miss Janice Missildine, Air Mobility Warfare Center Librarian, for the tremendous assistance she provided in obtaining research documents for this project.

Jeffrey J. Waters

Table Of Contents

	Page
Acknowledgments	iv
Table Of Contents	v
List of Figures	vii
Abstract	viii
Acronyms	ix
Chapter 1 – Introduction	1
Background	1
Research Questions	2
Scope	3
Methodology	3
Organization	4
Chapter 2 – Literature Review	5
The U.S. Army Transformation	5
Introduction	5
Overview	6
The Objective Force	9
The Legacy Force	10
The Interim Force	12
Deployment Timeline Considerations	13
Relevant Historical Deployment Analyses	15
Introduction	15
IBCT Preliminary Deployment Analysis	16
DARPA Early Entry Systems Study Report	16
USTRANSCOM IBCT Air Mobility Deployment Analysis	16
RAND SBCT Deployment Study	17
Chapter 3 – Research Method	18
Chapter 4 – Research Analysis	20
Objective Force Composition and Weight	20
U.S. Air Force Strategic Airlift Fleet in 2010	20
C-5 Galaxy	21

C-17 Globemaster III	22
Strategic Air Force Composition in FY 2010	23
Deployment Estimator Model Assumptions	24
Deployment Estimator Model Analysis and Results	25
Baseline Scenario	25
10000 STON Objective Force Brigade Weight Scenario	26
Pre-positioning / Forward Basing Scenario	28
Chapter 5 – Conclusions	30
Research Results	30
Shortfalls and Limitations	31
Recommendations for Future Research	32
Summary	32
Bibliography	33

List of Figures

	Page
Figure 1 – Army Transformation.....	8
Figure 2 – Major Legacy Force Systems.....	11
Figure 3 – Major Combat Systems in the Objective Force.....	20
Figure 4 – Strategic Airlift Estimate FY 2010.....	23
Figure 5 – Baseline Deployment Scenario Closure.....	26
Figure 6 – 10000 STON Scenario Closure.....	27
Figure 7 – Pre-positioning / Forward Basing Scenario Closure.....	29

Abstract

This paper analyzes the projected intertheater airlift requirements for the U.S. Army Objective Force brigade. The research focuses on analyzing these requirements and comparing them to the projected strategic airlift force structure in 2010 to determine if adequate airlift capability will be available to support the Army goal of deployment anywhere in the world within 96 hours. Background information describing the Army Transformation Program will present a framework for understanding the crucial role of the Objective Force brigade. This paper evaluates information obtained through military transportation organization interviews, articles, presentations, publications, and reports. Primary sources of information were: Air Mobility Command, United States Transportation Command, Defense Technical Information Center (DTIC) documents, and the Boeing Company. The analysis shows that although closure in 96 hours is possible in some cases, adequate strategic airlift capability will not be available to meet the Army goal for all possible worldwide scenarios. The baseline scenario required approximately 58% of available airlift to be allocated in order to successfully meet the 96-hour timeline. This is not a reasonable expectation given historical, current and projected future airlift requirements.

Acronyms

AMC	Air Mobility Command
APOD	Aerial port of debarkation
APOE	Aerial port of embarkation
AUSA	Association of the U.S. Army
CRAF	Civil Reserve Air Fleet
DTIC	Defense Technical Information Center
ER	Extended range
FCS	Future Combat System
GAMSS	Global Air Mobility Support System
GIG	Global information grid
IAV	Interim Armored Vehicle
IBCT	Interim Brigade Combat Team
IOC	Initial Operational capability
MC	Mission capable
MOG	Maximum on ground
NCA	National Command Authority
NCW	Network-centric warfare
PAA	Primary aircraft authorized
PCW	Platform-centric warfare
SAIC	Science Applications International Co-operation

SBCT	Stryker brigade combat team
STON	Short-ton
TAA	Tactical assembly area
TAI	Total aircraft inventory
TRADOC	U.S. Army Training and Doctrine Command
UA	Unit of action
UE	Unit of employment
USTRANSCOM	United States Transportation Command

Chapter 1 – Introduction

The attacks of September 11 provide compelling evidence that the strategic environment remains dangerous and unpredictable. The emerging strategic environment of the 21st Century demands land forces that are responsive, deployable, versatile, agile, lethal, survivable and sustainable across the full range of military operations.

--- Foreword to Army Transformation Roadmap

Background

The United States Army is in the process of transforming into a force that is “strategically responsive and dominant at every point of the spectrum of operations” (AUSA Transformation briefing, 2000). The importance of this Transformation has been highlighted by the unpredictability of the ongoing worldwide war on terrorism. On short notice, credible combat forces may be needed worldwide to respond to unforeseen contingencies. The central axis of the Army Transformation is the Objective Force. The units of the Objective Force combine the benefits of traditional light and heavy units to achieve prompt, full-spectrum supremacy while providing the largest number of strategic military response options to the United States.

Rapid deployment is crucial to providing responsiveness to leaders. The Army goal is to deploy a brigade combat team of the Objective Force anywhere in the world within 96 hours after liftoff (U.S. Army White Paper, 2002:9). Recognizing that there are numerous means to project power worldwide (airlift, train, fast sealift, etc.), the 96-hour requirement necessitates the responsiveness and speed of strategic airlift (based upon current sealift technology). Fast Sealift Ships are currently the fastest cargo ships in

operation by USTRANSCOM. These vessels required up to four days for activation and averaged only 23 knots at sea during Operation Desert Shield / Desert Storm (Matthews, 1996:119).

This paper will focus on the strategic airlift requirement. What will be the projected strategic airlift requirements for the Objective Force Brigade? Will the U.S. Air Force have the airlift capacity to meet these requirements? The goal of this paper is to analyze the projected airlift requirements for the Objective Force Brigade in the context of the overall Army Transformation Program to determine if the planned strategic airlift fleet will be capable of meeting the critical 96-hour Army deployment goal.

Research Questions

1. Primary Research Question

Will adequate strategic airlift capability be available in 2010 to support the 96-hour deployment goal of the U.S. Army Objective Force brigade?

2. Secondary Research Questions

- a. What will be the strategic airlift requirements for the Objective Force Brigade?
- b. What is the projected airlift force structure for the U.S. Air Force in 2010?
- c. Will this force structure allow the Army to meet its Objective Force Brigade deployment requirements?

Scope

This research focuses on providing an analysis of projected Objective Force brigade airlift requirements. Specifically, the paper will focus on the initial strategic deployment requirements for a medium-sized force (brigade) to any location worldwide. Research will be limited to the strategic airlift (via C-17 and C-5 aircraft) of these forces. Other modes of transportation currently in research and development (e.g. fast sealift, advanced airlift technologies) will not be examined in order to focus on current strategic airlift capabilities. Additionally, this paper will provide background material regarding the Army Transformation in order to build a framework for understanding the crucial role of the Objective Force.

Methodology

This paper incorporates and evaluates information obtained through civilian and military transportation organization interviews, articles, presentations, publications, and reports.

Primary sources of information for this paper include, but are not limited to, the following:

- Air Mobility Command (AMC)
- United States Transportation Command (USTRANSCOM)
- Defense Technical Information Center (DTIC) articles and publications
- The Boeing Company
- United States Army Training and Doctrine Command (TRADOC)

Analysis Center

Organization

Chapter two reviews the Army Transformation plan, highlighting the importance of rapid Objective Force deployment. This chapter will discuss the Objective Force Axis of Transformation, including new Future Combat System technologies, in detail. Additionally, the results of several relevant deployment analyses will be summarized.

Chapter three describes the research method utilized to obtain the U.S. Army Objective Force deployment data and U.S. Air Force airlift force composition projections. It also describes the Deployment Estimator Model used to analyze the strategic airlift capabilities.

Chapter four addresses the composition and airlift requirements of the Future Combat Systems within the construct of the Objective Force. Since the Objective Force is still in the developmental phase, some of this information will be speculative. In addition, this chapter will examine the projected composition and capabilities of the U.S. Air Force strategic airlift (C-17 and C-5) fleet in 2010. Finally, chapter four presents the assumptions, analysis and results of the Deployment Estimator Model.

Chapter five will then summarize the findings and conclusions of this research, and recommend additional research based on the results of this paper.

Chapter 2 – Literature Review

The U.S. Army Transformation

“The Army’s contribution to national security is prompt and sustained land dominance across the range of military operations and spectrum of conflict.”
-- Army Transformation Roadmap, 2002

Introduction

According to Joint Vision 2020, the primary purpose of America’s armed forces has been and will be to fight and win the Nation’s wars. The focus of Joint Vision 2020 is full spectrum dominance, enabled by new technologies and transformation of the joint force (Joint Vision 2020, 2000). The U.S. Army, which serves as the “land component member of the joint warfighting team” at the direction of Chief of Staff of the Army General Eric K. Shinseki, has embarked on a fundamental conceptual change in the way it performs its role in meeting the goals of the National Security Strategy (Army Vision 2010, 2000).

Operation Desert Shield highlighted a crucial deficiency in the force structure of the Army. Faced with defending Saudi Arabia from Iraqi armored forces, the Army was forced to choose between rapidly deploying (by air) light forces lacking lethality and survivability, or the slower deployment of more capable heavy forces (armored divisions). The decision to deploy the 82nd Airborne Division could have resulted in heavy U.S. casualties, as they were not designed or equipped to effectively repel a heavy armor attack. Fortunately, this was not the result. Additionally, the U.S. Army was allowed almost five months to assemble and deploy its forces to the Persian Gulf – a luxury which might not be afforded to it in future conflicts. Operation Task Force Hawk further highlighted an Army

with a “weight problem”. The deployment of an Army unit numbering less than a division required two weeks to deploy, and was composed of vehicles which were too heavy for the Albanian roads. General Shinseki made these concerns known soon after becoming Chief of Staff:

More than ten years ago, during the buildup of Operation Desert Shield, the Army identified an operational shortfall—a gap between the capabilities of our heavy and light forces. Our heavy forces are the most formidable in the world. There are none better suited for high-intensity operation, but they are severely challenged to deploy to all the places where they might be needed. Conversely, our magnificent light forces are agile and deployable. They are particularly well suited for low-intensity operations, but lack sufficient lethality and survivability. There is, at present, no rapidly deployable force with the staying power to provide our leadership with a complete range of strategic options (2001 U.S. Senate Statement).

The events of September 11 and the resulting global war on terrorism have only reinforced these concepts. Future threats to the security and interests of the United States will likely not provide the forewarning and buildup time required to deploy present-day heavy personnel and equipment. The need for a worldwide, rapidly deployable, survivable, and lethal combat force is essential to providing a swift and effective response option to unconventional, asymmetrical and disparate threats from individuals, groups, and nation-states across the globe.

Overview

The Army Transformation goes beyond developing new technologies, weapon systems, and platforms. Army Transformation “combines advanced technologies, organizations, people and processes with concepts to create new sources of military power that are more responsive, deployable, agile, versatile, lethal, survivable, and sustainable” (Army Transformation Roadmap, 2002). Central to this transformation is the conceptual shift from platform-centric warfare (PCW) to network-centric warfare (NCW). PCW is characterized by a focus on the individual weapon platforms for engaging the enemy, as

well as for metrics to assess performance. The capability of the force is the sum of the capabilities of the weapon platforms comprising that force. NCW, in contrast, focuses on the collaborative, timely communication between weapon platforms on the battlefield. This creates a synergy, in that the resulting capability of the force is much greater than the sum of the individual components (Kwinn, 2001). FCS will be essential in this shift to NCW by providing the greatly enhanced battlefield communication and networking capabilities.

A simplified example to highlight the differences between PCW and NCW is a friendly tank crew engaging an enemy tank. In PCW, a tank crew would individually and sequentially acquire, track, and engage the enemy target, repeating this process as necessary until it is destroyed. The tank crew on a network-centric battlefield would engage the enemy using a dramatically different process. The sharing of real-time battlefield information would allow him to simultaneously acquire, track and engage numerous targets on the battlefield, while providing information on these targets to other friendly forces and commanders. This process greatly enhances the overall effectiveness of the individual tank and the friendly forces on the battlefield (Kwinn, 2001).

The goal of Army Transformation is the development of and transition to, the Objective Force. The Transformation will be accomplished in three axes: the Objective Force, the Legacy (current Army) Force and the Interim Force (See Figure 1).

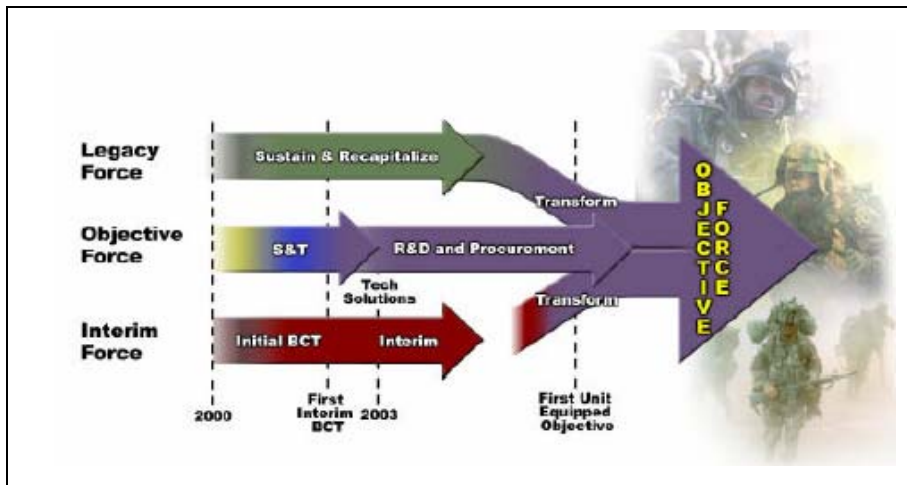


Figure 1 - Army Transformation

(AUSA Army Transformation Brief, 2000)

The Army today, while one-third the size of the Cold War era Army, is subject to a much higher operations tempo. During the 40 years from 1950 to the end of the Cold War, the Army conducted 10 deployments. In the six years from 1990 to 1996, the Army deployed 25 times (Army Vision 2010). A 2001 Rand study concluded that for Army soldiers in operational units, the average time deployed has increased by almost 30 percent between 1997 and 2000 (Polich, 2001:xii). This higher operations tempo and reduced force structure highlights the critical need for Army transformation. When Iraq invaded Kuwait in 1990, the Army's heavy equipment and divisions required valuable time during the buildup of forces, to be transported to Southwest Asia. Future engagements may not permit a buildup of forces, and while the Army's light infantry can quickly deploy worldwide, it lacks the "lethality, survivability, and staying power of the heavy forces" (Army Transformation Roadmap, 2002). This "capabilities gap" between the Army's heavy forces and light forces highlights the need for a transformation to a force combining the best aspects of the two – the Objective Force.

The Objective Force

The Objective Force will have the ability to “deploy from multiple points of origin to multiple points of entry, in remote areas with unimproved infrastructure, and operate with a minimal logistical trail” (Army Transformation Roadmap, 2002). Additionally, it will be able to “deter hostile acts against U.S. forces through its speed, power, and precision, even while its agility and reduced footprint reduce its vulnerability” (Army Transformation Roadmap, 2002). The Transformation to the Objective Force will take thirty years to complete and will bridge the capabilities gap between heavy divisions and light infantry units. Units in the Objective Force will be structured as “units of action” (UA) and “units of employment” (UE). The UAs – similar to the current battalions and brigade combat teams, are the maneuver and engagement units. The UEs are the “planners, synchronizers and supporters” (Aadland, 2002). This UA and UE force will be rapidly deployable to anywhere in the world and networked together with constant, accurate, real-time battlefield information. This information will be provided by a network of sensors and databases on the ground, in the air, and in space, known as the Global Information Grid (GIG) - allowing the Army commander to have a complete, accurate picture of the battlefield, while denying the enemy the same. This will enable the light, lethal, but numerically smaller Objective Force to destroy a much larger group of enemy units. The Army plans to begin equipping the Objective Force in 2008, with Initial Operational Capability (IOC) by 2010.

The Objective Force is designed to be rapidly deployable. According to the Department of the Army, the goal is “to deploy a brigade combat team anywhere in the

world in 96 hours after liftoff, a division on the ground in 120 hours, and five divisions in 30 days” (U.S. Army White Paper, 2001:9).

The Legacy Force

The Legacy Force will enable the Army to fight and win the nation’s wars while the Objective Force is being developed over the next thirty years. It consists of both light forces and heavy forces. The light “forced entry” component consists of the 101st Airborne Division (Air Assault), 82d Airborne Division, 10th Mountain Division, 25th Light Infantry Division and the 29th Light Infantry Division (National Guard). The “early entry” component consists of the 1st and 2d Infantry Division and the 1st Armored Division, together with seven National Guard Divisions and eight National Guard enhanced Brigades. These light forces are both responsive and deployable, but lack the firepower and survivability to effectively shift to the higher end of the spectrum of military operations. The heavy component of the Legacy force consists of the 1st Cavalry Division, 4th Infantry Division, 3d Infantry Division and 3d Armored Cavalry Regiment. The heavy forces are lethal and survivable, but due to their weight and logistics requirements, are not as responsive and deployable as the light forces. Additionally, they are not easily or rapidly transported between theaters of operation.

Between 1990 and 2000, the Army did not procure any new major weapon systems. Consequently, the major systems in the Legacy force are already 20-40 years old and are programmed to continue in service for another 30 years (see Figure 2).

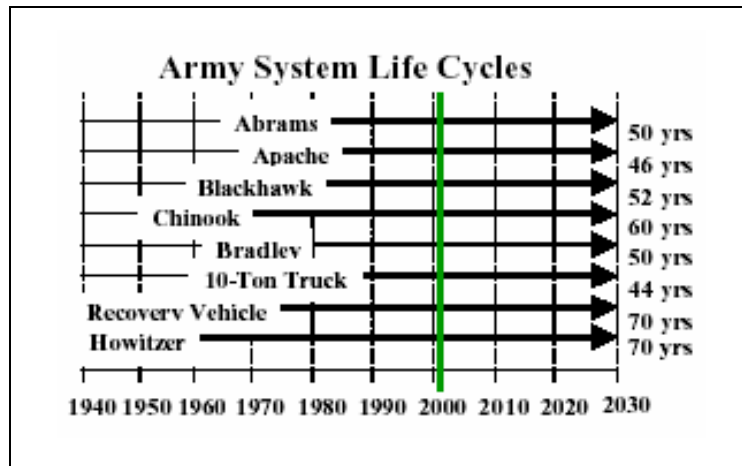


Figure 2 – Major Legacy Force Systems

(AUSA Army Transformation Brief, 2000)

The challenge facing the Legacy Force is the “Recapitalization” of these major systems. Recapitalization is “the rebuild and selected upgrade of currently fielded systems to ensure operational readiness and a zero time / zero mile system” (AUSA Army Transformation Brief, 2000). Twenty-one current systems were identified by the Army for Recapitalization. This process is much less expensive than procuring new weapons. The systems selected for rebuild will receive new technologies to improve reliability and maintainability. Selected systems will be upgraded to solve previously identified warfighting capability deficiencies. The Recapitalization effort includes minimal modernization in order to focus limited resources on the development of the Interim and Objective Forces.

The Interim Force

The Interim Force will bridge the capabilities gap between the light and heavy forces, providing the combatant commanders a near-term, rapidly deployable force able to operate across the spectrum of military operations until the technology of the Objective Force is developed. Six combat brigades will be fully converted to Interim Brigade Combat Teams (IBCTs). The IBCT concept is a “rapidly deployable, combat brigade task force that will be centered around an Interim Armored Vehicle (IAV)” (AUSA Army Transformation Brief, 2000). The IAV will use off-the-shelf equipment and has been designated the “Stryker” vehicle. These forces will be trained and deployable, possessing some of the desired characteristics of the Objective Force in terms of lethality, survivability, agility, and sustainability. The IBCT was renamed the Stryker Brigade Combat Team (SBCT) in August 2002. The SBCT is a “medium-weight” force. It is approximately half the weight of a heavy brigade and twice the weight of a light brigade. The first two SBCTs will be based at Fort Lewis, Washington and are expected to be operational and ready for deployment in 2003 –2004. Subsequent SBCTs are forecasted to be located in Fort Wainright, Alaska, Fort Polk, Louisiana and Schofield Barracks, Hawaii.

The SBCTs are also designed to be rapidly deployable. All vehicles are required to be air-transportable via C-130 aircraft and be immediately capable of combat operations upon debarkation from the aircraft. The deployment goal for the SBCT is anywhere worldwide within 96 hours from liftoff.

Deployment Timeline Considerations

There are many factors to consider when estimating the deployment time for a unit. These include (but are not limited to):

1. Mobility assets (airlift / tankers) allocated to deploy the forces and Civil Reserve Air Fleet (CRAF) participation
2. Maintenance reliability / utilization rates for airlift aircraft
3. Aircrew availability / restrictions for airlift missions
4. Proximity of deploying units to aerial port of embarkation (APOE)
5. Size and weight of deploying unit (number of vehicles, weight, oversize / outsize cargo, hazardous materials)
6. Airfield operating hours, infrastructure and maximum on ground (MOG) at APOE, enroute bases, and aerial port of debarkation (APOD)
7. Overflight rights for mobility aircraft
8. Departure, enroute and arrival weather
9. Distance, transportation network and terrain from APOD to Tactical Assembly Area (TAA)

Previous deployment studies indicate that some of the most important factors are: the airlift fleet allocated to the deployment, the size and weight of the deploying force, and the MOG at enroute bases and the APOD.

Airlift missions are allocated according to their priority. While day to day “peacetime” missions fall lower on the priority list than wartime missions, there are higher priority alert commitments and missions, such as National Command Authority

(NCA) movements and maintenance requirements which prevent all operationally available aircraft from being allocated to a contingency. Additionally, other services and requirements compete for available lift at the same priority level during contingencies. During the first 60 days of Operation Desert Shield, for example, the entire U.S. Army was allocated only 40 percent of the available strategic airlift fleet (RAND analysis, 1993). As a more recent example, during the Kosovo conflict only 12 C-17 airlifters were allocated for use in theater to move the U.S. Army's Task Force Hawk (Begert, 1999).

The size and weight of a deploying unit have a tremendous impact on deployment times. While both strategic airlifters remaining in the active inventory (C-5 and C-17) are now able to carry outsize cargo; the C-130 cannot. Additionally, an aircraft will often "cube out" (or run out of interior space) before it reaches maximum weight. Even minor reductions in weight can dramatically affect deployability. A 2001 USTRANSCOM IBCT deployment analysis found that for each 1000 STON change in weight, the 96 hour deployable range changed by 300 NM (USTRANSCOM IBCT briefing, 2001).

Finally, enroute and destination infrastructure and MOG directly affect closure times. Fuel and hot cargo parking availability are especially critical to ensure that potential throughput is not reduced. In an ideal scenario, facilities at both APOE and APOD are capable of supporting the robust throughput that the strategic deployment of an Objective Force brigade would require. This would probably be the case for the APOE, since the Objective Force brigades will most likely be deployed from U.S. Air Mobility Command bases with existing (organic) support facilities and personnel. Unfortunately, many locations worldwide do not possess an adequate level of

infrastructure and personnel to effectively receive these forces. The very nature of future conflict regions places them farther away from existing large airports or military bases than their historical counterparts. The Global Air Mobility Support System (GAMSS) consists of permanent support locations worldwide and specialized units designed to rapidly deploy with personnel and equipment to provide infrastructure where and when needed. Unfortunately, the AMC worldwide enroute system has been drastically reduced from 40 permanent overseas locations and 5,300 personnel in 1992 to 12 permanent overseas locations and less than 4,000 personnel today (AMC Strategic Plan 2002). This necessitates the deployment of air mobility support elements to provide aircraft support at many bases with little or no existing infrastructure, or to augment or replace infrastructure damaged due to a conflict. These elements must be delivered before the flow of equipment and personnel begin – adding to the overall closure time.

Relevant Historical Deployment Analyses

Introduction

Several deployment analyses have been made for the IBCT (and later SBCT). Since the Objective Force brigade and SBCT share a common deployment timeline goal, a review of these analyses provides useful information regarding requirements, limitations and recommendations. Although each analysis utilized different assumptions (unit size / weight, airlift fleet size / allocation, enroute infrastructure, destinations, etc.), the results highlight fundamental findings and recommendations.

IBCT Preliminary Deployment Analysis

The U.S. Army Transformation Axis Team briefed the results of an initial airlift deployment study in January of 2000. This study indicated that the deployment of an IBCT would require between 6.3 and 7.4 days to close (using then current estimated IBCT weights and forecasts for available airlift). One of the final conclusions of this study was that “Unit weight must be less than 7,800 short-tons (STONS) to close in 96 hours” (Four-Star Conference BCT briefing, 2000). This study assumed that adequate infrastructure would be in place at the APOD at the start of the deployment (no time or airlift allotted for deployment of personnel and equipment for this purpose).

DARPA Early Entry Systems Study Report

A May 2000 Defense Advanced Research Projects Agency (DARPA) study final report indicated that the deployment of a medium-weight brigade in 96 hours to an APOD 5,425 NM away would require a unit weight of less than 8,100 STONS. Once again, this study assumed that the APOD was already open and operating. Additionally, this report highlighted the importance and limitations of MOG restrictions to closure timelines and recommended further analysis of other transportation alternatives such as advanced airlift / sealift and prepositioning.

USTRANSCOM IBCT Air Mobility Deployment Analysis

In August of 2001, United States Transportation Command (USTRANSCOM) briefed the results of an IBCT Air Mobility Deployment Analysis. The study involved 7 origins and 8 geographic destinations, for a total of 56 scenarios. The results indicated that none of the 56 scenarios modeled closed in less than 4 days. This study highlighted the

importance of hot cargo infrastructure and MOG at enroute locations and the additional time and airlift required for a Global Reach Laydown (GRL), if required to improve infrastructure. Additionally, decreasing the size and weight of the IBCT was found to proportionally reduce closure times. Other recommendations for improving closure times included forward-basing an IBCT in Europe, and refining the ammunition deployment Concept of Operations (CONOPS) (i.e., the hot cargo requirements at airfields).

RAND SBCT Deployment Study

A 2002 RAND study examined the ability of the Air Force to meet the 96 hour deployment goal for the SBCT. The conclusion of the report was that “a force with more than 1,000 vehicles cannot be deployed by air from CONUS to the far reaches of the globe in four days” (RAND, 2002:xiv). It also suggested that forward-deploying of SBCT units and pre-positioning of equipment would shorten closure times and “offers the ability to deploy the SBCT by air or sea to key regions in 5 to 14 days” (RAND, 2002:115). The report also recommended using fast, shallow-draft ships to speed some deployments, depending on the scenario.

Chapter 3 – Research Method

This research paper combines relevant information from various sources in order to provide a realistic assessment of Objective Force Brigade composition and strategic airlift requirements. Additionally, it evaluates the current programmed airlift fleet for the U.S. Air Force on or about fiscal year 2010. The research method utilized various media types including technical reports, magazine and journal articles, theses, Internet media, government periodicals, e-mails, briefings, teleconferences, and in-person interviews.

Since the Future Combat System and Objective Force Transformation are currently in the early stages of development, its composition, capabilities and requirements (including airlift) are still somewhat speculative in nature. The primary source for obtaining current Future Combat System / Objective Force brigade information was the Boeing/Science Applications International Co-operation (SAIC), the lead systems integrator for the FCS. Although every attempt was made to obtain the most current, accurate information for the FCS, ongoing technological and capabilities development may change or alter the assumptions used in this paper. The information on U.S. Air Force airlift force composition was obtained primarily from Air Mobility Command and USTRANSCOM, and represents the most current projections available for the mobility airlift fleet.

The model used for airlift requirements analysis is a TRADOC Analysis Center at Fort Lee mathematical spreadsheet model called the Deployment Estimator. This model uses the transportation profile of a unit (in STONs) and Air Force planning factors (from AFP 10-1403) to estimate the strategic airlift deployment requirements and timelines for

a unit. Factors such as MOG, overall system efficiency, CRAF participation and airfield operating hours may be adjusted to model a desired scenario.

Chapter 4 – Research Analysis

Objective Force Composition and Weight

Although the composition and weight of the Future Combat System and Objective Force are still in development, current estimates place the weight of an Objective Force brigade, including 3 days of ammunition and other supplies, at approximately 11,000 STONs (FCS-DRA Brief, 2003). Future research and development may significantly change this number. Major Combat Systems in the Objective Force Brigade are shown in Figure 3.

Combat System	Quantity
Infantry Carrier Vehicle	42
Mounted Combat System	54
Non line-of-sight (NLOS) mortar	24
NLOS Cannon	18
Reconnaissance/Attack Helicopter	12

Figure 3 – Major Combat Systems in the Objective Force

(FCS-DRA Brief, 2003)

U.S. Air Force Strategic Airlift Fleet in 2010

The current strategic airlift fleet consists of C-5 Galaxy aircraft, C-17 Globemasters and C-141B Starlifters. All 1960-era C-141B Starlifters are scheduled to be retired by FY 2010. Although KC-10 and KC-135 aircraft can also be utilized for strategic airlift, they are in extremely high demand as air refueling platforms, especially

during contingency operations. Additionally, neither is capable of handling outsize cargo or rolling stock – both of which are necessary for the deployment of the Objective Force Brigade.

C-5 Galaxy

The C-5 Galaxy is the largest United States military aircraft. Its primary role is the inter-theater airlift of outsized cargo (such as M1 tanks and helicopters). Cargo doors and ramps at both the nose and tail of the aircraft allow payloads to be loaded and unloaded efficiently. The C-5 can also be configured for strategic or tactical airdrop of heavy loads and personnel, but is seldom utilized in this role. Although it is capable of landing on airfields as short as 6000 feet, its unique servicing and loading requirements favor larger, established airports over austere fields. The C-5 is capable of ferrying a cargo load of 270,000 lbs (135 STONs) a distance of 2,150 nautical miles, offloading the cargo, and then flying to a second base 500 nautical miles away from the original destination – all without air refueling (C-5 Galaxy Fact Sheet, 2003).

The C-5 has been in service with the Air Force since 1970. As a result, C-5 mission capable (MC) rates have fallen to the around 65%, well below the AMC programmed MC rate of 75%. In order to extend the service life of the aircraft, Air Mobility Command has chosen to implement a phased modernization plan that includes upgraded avionics, new engines, and other reliability improvements for some of the aircraft. Currently, there are 126 C-5 aircraft in the fleet – 74 A models (built in the 70s), 2 unique C models, and 50 B models (built in the mid 1980s). At least 52 of the C-5s will be modernized, starting with the B models. Fourteen of the oldest (and poorest

performing) A models are scheduled to be retired. These upgrades are programmed to improve MC rates by 13.5% and save \$8.6 billion dollars (Air Mobility Modernization Briefing, 2003).

C-17 Globemaster III

The C-17 Globemaster III is the newest aircraft in the airlift fleet. It entered service in 1993. The C-17 occupies approximately the same ramp space as a C-141. It is uniquely capable of delivering outsize cargo to small, austere landing zones (as small as 3000 feet by 90 feet). The C-17 was specifically designed for “direct delivery” – the ability to deliver cargo from port of embarkation to final destination in-theater, without trans-loading to other transportation modes or tactical airlift platforms (such as the C-130). This makes the C-17 uniquely capable of both a strategic and tactical airlift mission. The C-17 is also capable of aerial delivery of personnel and equipment. The C-17 can upload 80 tons of cargo and fly 2400 nautical miles without refueling. Recent operations in Afghanistan and Iraq have demonstrated the multi-role effectiveness of this aircraft (C-17 Globemaster Fact Sheet, 2003).

The addition of extended range (ER) tanks to the newest C-17s adds 10,000 more gallons of fuel, increasing the maximum un-refueled range of the aircraft from 4,600 to 6,200 nautical miles.

Boeing has been contracted to deliver 180 C-17 aircraft to the U.S. Air Force. It is important to note that while the conversion from C-141 to C-17 aircraft will increase the overall lift capability available, the reduction in aircraft from over 260 C-141s to 180 C-17s means fewer aircraft available to support a contingency.

Strategic Airlift Force Composition in FY 2010

Assuming no additional C-17 aircraft are purchased, the total aircraft inventory (TAI) will be 180 by 2010. Of these 180 aircraft, approximately 156 may be considered primary aircraft authorized (PAA). Subtracting predicted maintenance and operational withheld aircraft from this number will leave approximately 127 C-17 aircraft available for operational use (see Figure 4).

Of the 126 C-5 aircraft currently in the inventory, 16 are projected to be retired. All 52 of the B-models will be upgraded by 2010. Assuming the remaining 52 A models are still in the inventory, the C-5 TAI will be 104. Of these 104 aircraft, approximately 96 may be considered PAA. Subtracting maintenance and operational withheld aircraft from this number will result in approximately 71 C-5 aircraft available for operational use (see figure 4).

	C-5	C-17
Total Asset	104	180
PMAI	96	156
MX withholds	22	18
<u>Operational withholds</u>	<u>3</u>	<u>11</u>
Available Aircraft	71	127
20% of available	14	25
30% of available	21	38
40% of available	28	50
50% of available	35	63
60% of available	42	76

Figure 4 – Strategic Airlift Estimate FY 2010

Deployment Estimator Model Assumptions

The scenario chosen for evaluation was the deployment of an Objective Force Brigade from Schofield Barracks, Hawaii to South Korea. In order to simplify the scenario, a single APOD was chosen in-theater with a limiting MOG of six. An enroute stop for refueling and crew change on the deployment and re-deployment legs is also assumed. This enroute base is assumed to have no MOG or aircrew limitations.

Other assumptions included:

1. The baseline availability of strategic airlifters was 20% of the fleet, with additional calculations for 30%, 40%, 50% and 60% fleet allocation.
2. The brigade deployed with equipment and three days of supply (DOS) using the most current estimate for weight available (11,028 STONs).
3. No commercial aircraft were utilized to move cargo or personnel (no CRAF mobilization or participation).
4. MOG at the APOE would not constrain deployment flow.
5. MOG at the APOD would be six aircraft with sufficient hot cargo pads to support unrestricted deployment flow.
6. Both airfields would be open and operating 24 hours a day from beginning of the deployment to end (adequate infrastructure, lighting).
7. Hickam AFB to Osan AB distance was used for this scenario (approximately 4000 nautical miles one way / 8000 nautical miles round trip).
8. There are no other users competing for MOG at either airfield (non-government organizations, private volunteer organizations, allied nations, etc.).
9. No other forces (joint or allied) are involved in the deployment.

10. The APOD serves as the TAA for the deployment (deployment is complete once forces are at the APOD).

11. Aircrew restrictions are waived in order to allow one aircraft to complete a round-trip from APOE to APOD and return.

12. Aircraft USE rates, payload, ground times, block speeds and other mobility

Planning factors were taken from AFPAM10-1403:

	<u>C-5A/B</u>	<u>C-17</u>
Block Speed	422	412
Payload (Cargo)	61.3	45
Ground Time (Expedite)	2.0 hrs	1.75 hrs
UTE Rate (Contingency)	7.7/8/1	12.5

Deployment Estimator Model Analysis and Results

Baseline Scenario

Analysis began with the baseline scenario of 20% available airlift allocation and a MOG of six aircraft at the APOD. Under these constraints, the Objective Force brigade closed in 10.6 days – 6.6 days longer than the 96-hour goal. The Deployment Estimator revealed that the limiting factor was amount of airlift allocated for this set of conditions. Increasing the MOG did not improve the closure time. Increasing the airlift allocation resulted in shorter closure times as follows:

30% allocation	7.2 days
40% allocation	5.6 days
50% allocation	4.5 days
60% allocation	3.8 days

Further analysis revealed that an allocation of approximately 58% of available airlift was required to achieve a closure time of 96 hours for the baseline scenario.

Decreasing the MOG resulted in none of the scenarios closing in the required 96 hrs (see Figure 5). This highlights the criticality of MOG to closure time and the importance of multiple APODs when higher MOGs are not possible due to limited infrastructure.

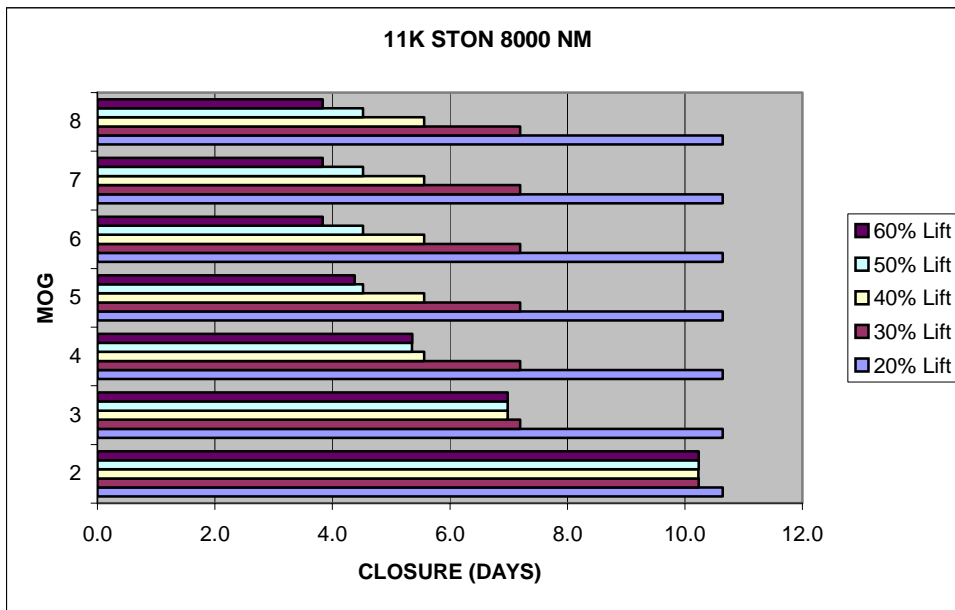


Figure 5 – Baseline Deployment Scenario Closure

10000 STON Objective Force Brigade Weight Scenario

The effect of changing the weight of the Objective Force brigade was also analyzed. Using the baseline scenario of 20% available airlift allocation and a 10000 STON weight, the Objective Force brigade closed in 9.9 days – 5.9 days longer than the 96-hour goal. The Deployment Estimator revealed that the limiting factor was still amount of airlift allocated for this set of conditions. Increasing the MOG did not improve the closure time.

Increasing the airlift allocation resulted in shorter closure times as follows:

30% allocation	6.7 days
40% allocation	5.2 days
50% allocation	4.2 days
60% allocation	3.6 days

Further analysis revealed that an allocation of approximately 53% of available airlift was required to achieve a closure time of 96 hours for this scenario.

Decreasing the MOG resulted in only the 60% lift allocation scenario closing in the required 96 hrs using a MOG of 5. For a MOG of less than 5, none of the scenarios closed in less than the required 96 hours (see Figure 6).

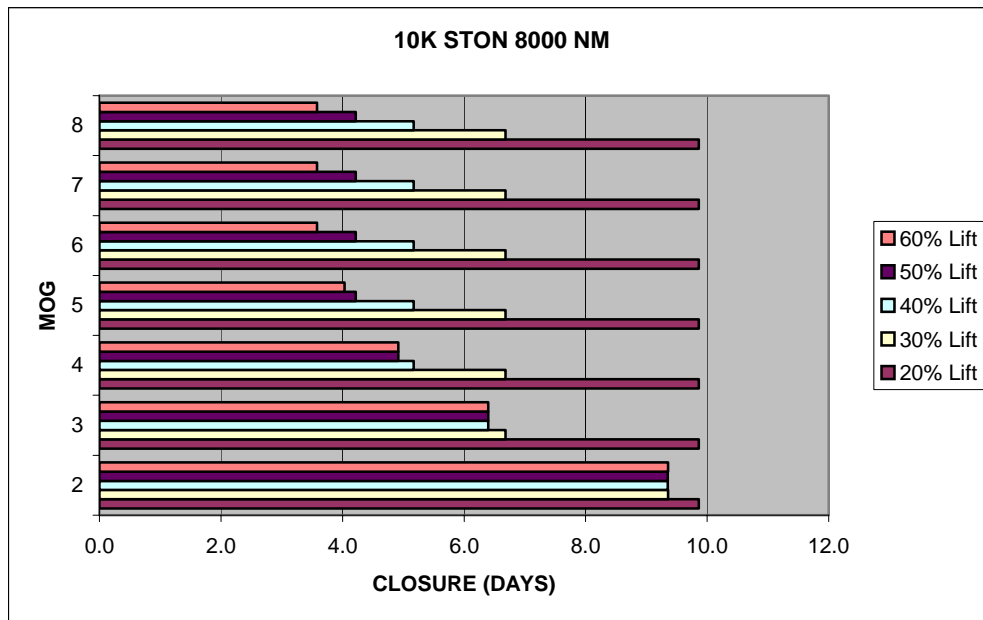


Figure 6 – 10000 STON Scenario Closure

Pre-positioning / Forward Basing Scenario

The final analysis was done to evaluate the benefits of an overseas-based brigade and/or the pre-positioning of equipment. In order to accomplish this, the distance for the scenario was reduced to 2500 NM (5000 NM round trip). Using the baseline scenario of 20% available airlift allocation and a 11000 STON weight, the Objective Force brigade closed in 6.8 days – 2.8 days longer than the 96-hour goal. The Deployment Estimator revealed that the limiting factor was still amount of airlift allocated for this set of conditions, until 40% of airlift was allocated. At that point, MOG became the limiting factor. Increasing the airlift allocation resulted in shorter closure times as follows:

30% allocation	4.6 days
40% allocation	3.6 days
50% allocation	3.6 days
60% allocation	3.6 days

Further analysis revealed that an allocation of approximately 36% of available airlift was required to achieve a closure time of 96 hours for this scenario.

Decreasing the MOG resulted in none of the lift allocations scenarios closing in the required 96 hrs. Increasing the MOG improved the closure times for the 50% and 60% airlift allocations (see Figure 7).

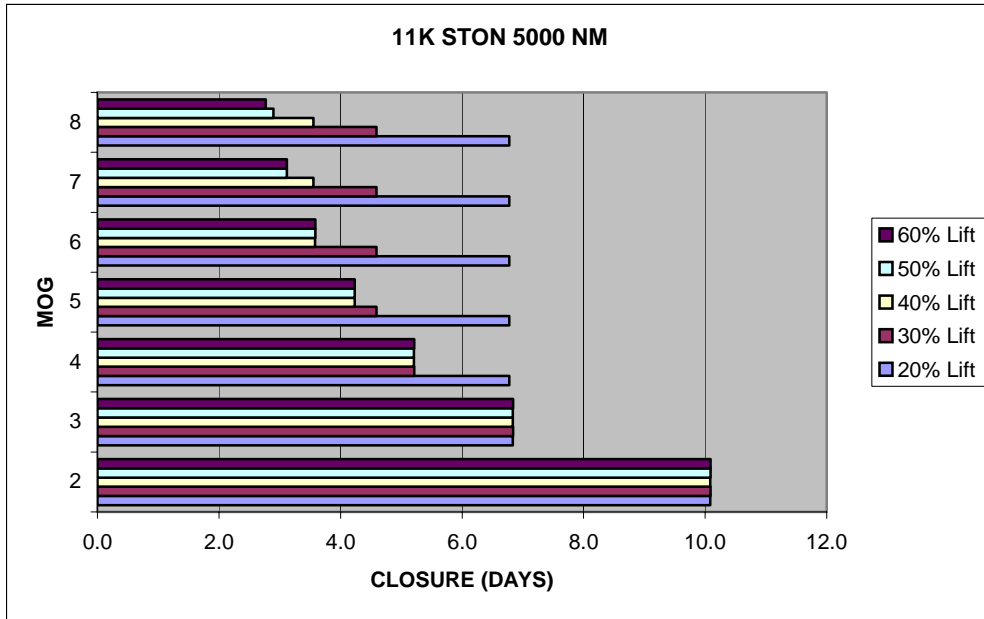


Figure 7 – Pre-positioning / Forward Basing Scenario Closure

Chapter 5 – Conclusions

Research Results

The stated goal for deployment of the Objective Force brigade is “anywhere in the world within 96 hours from liftoff.” Utilizing the latest forecasts for brigade weight and available strategic airlift in 2010, the baseline scenario required an allocation of approximately 58% of operationally available airlift to close in 96 hours. The analysis shows that although closure in 96 hours is possible in some cases, adequate strategic airlift capability will not be available to meet the Army goal for all possible worldwide scenarios. An airlift allocation of 58% of the available fleet for a single deployment cannot be reasonably expected, based upon historical, current and projected future airlift requirements.

The deployment analysis also indicates that there are several ways to significantly improve closure times. Reducing the overall weight of the Objective Force brigade will result in decreased closure times and reduced airlift requirements. Increasing the number of APODs available and MOGs at these locations, in general, will also positively affect closure times. Finally, forward basing and prepositioning of equipment have a large effect on closure times. While prepositioning does not meet the U.S. Army intent of rapid global responsiveness, overseas basing of one or more Objective Force brigades would substantially improve closure times.

Shortfalls and Limitations

There are several shortfalls in the research presented in this paper. First, the baseline scenario does not model all possible deployment locations worldwide. The baseline scenario 4,000 NM deployment is much less than the approximately 11,000 NM distance halfway around the world and does not accurately simulate deployment distances at both ends of the spectrum.

The Deployment Estimator Model is limited in its capabilities. It can only model a single APOE and APOD using generalized aircraft and airfield planning factors. Additionally, it is limited to modeling deployments using only airlift resources. A more complex deployment model would utilize an actual Time Phased Force Deployment Data (TPFDD) list of personnel and equipment to more accurately model the loading efficiency of the aircraft. Ideally, this model would also be able to simulate multiple APODs and enroute bases, and other factors such as weather, maintenance delays, competing lift requirements, air-refueling and infrastructure limitations. A more robust model would also be able to simulate other modes of transportation, including technologies in development, as well as combinations of airlift, sealift and prepositioning.

There were several other limitations imposed on this research. The data for Objective Force brigade composition and weight is still in development and subject to frequent updates. The projections for strategic airlift are also in flux and will probably change considerably by 2010.

Recommendations for Future Research

The first area for future research would be to utilize a theoretical or actual TPFDD for the Objective Force brigade - once the development of the technologies and force structure permits it. Additionally, emerging advances in high-speed sealift necessitate an in-depth analysis of this transportation mode, especially for shorter deployment distances and the longer timelines envisioned for the Objective Force divisions. Future research should also consider the impact of forward basing and CRAF mobilization to deployment timelines.

Summary

Clearly, Army Objective Force deployment goals rely heavily on the ability of strategic airlift to rapidly deploy its forces worldwide. Competing requirements for limited airlift necessitate investigation into other transportation modes and forward-basing options. Strategic airlift will not, by itself, have the capability to rapidly deploy the Army Objective Force brigade worldwide to all possible locations within 96 hours due to limited capacity and ongoing commitments. A successful strategy for rapid worldwide deployment will most likely combine forward basing / prepositioning with other modes of transportation, including advanced airlift / sealift and the participation of civilian carriers. The demands for strategic airlift will not decrease for the foreseeable future. Only by exploring and exploiting other available technologies and transportation options will the Army and other airlift users ensure that adequate resources will exist to rapidly and effectively project combat power worldwide when and where required.

Bibliography

- Aadland, Anders B. and James L. Allen. "Engineer White Paper – Into the Objective Force," *Engineer*, April 2002.
- Air Mobility Command Public Affairs Office. "C-17 Globemaster Fact Sheet," http://www.af.mil/news/factsheets/C_17_Globemaster.html. 2003.
- Air Mobility Command Public Affairs Office. "C-5 Galaxy Fact Sheet," http://www.af.mil/news/factsheets/C_5_Galaxy.html. 2003.
- Association on the U.S. Army (AUSA). "Army Transformation Briefing." Powerpoint Briefing. 17 October 2000.
- Begert, William J. "Kosovo and Theater Air Mobility," *Aerospace Power Journal*, Winter 1999.
- Center for Army Analysis. "Future Combat System Deployability and Responsiveness Analysis (FCS-DRA) Study," briefing, 7 February 2003.
- Department of the Army. *Army Vision 2010*. Washington D.C.: U.S. Government Printing Office, 1996.
- Department of the Army. *United States Army White Paper: Concepts for the Objective Force*. Washington D.C.: U.S. Government Printing Office, 2001.
- Department of Defense. *Joint Vision 2020*. Washington D.C.: U.S. Government Printing Office, 2000.
- Headquarters Air Mobility Command. "Air Mobility Modernization," briefing, 2003.
- Kwinn, Michael J., Jr. *A Framework for the Analysis of the Future Combat System Conceptual Design Alternatives*. West Point, New York, April 2001.
- Lund, John et al., *Project AIR FORCE Analysis of the Air War in the Gulf: An Assessment of Strategic Airlift Operational Efficiency*. Santa Monica Calif.: RAND, 1993.
- Matthews, J. K. and Cora J. Holt. *So Many, So Much, So Far, So Fast: United States Transportation Command and Strategic Deployment for Operation Desert Shield/Desert Storm*. Washington D. C.: U.S Government Printing Office, 1996.
- Polich, Michael and Ron Sortor. *Deployments and Army Personnel Tempo*. Santa Monica Calif.: RAND, 2001.

Shinseki, E. K. and T.E. White. *Army Transformation Roadmap*. Washington D.C.: U.S. Government Printing Office, 2001

Shinseki, E. K. and T.E. White. U.S. Army Transformation Report to the United States Senate, 2001.

U.S. Air Force, Air Mobility Command. *AMC Strategic Plan 2002*.

U.S. Army Transformation Axis Team. “Transforming the World’s Best Army into a Full Spectrum Force.” Briefing to Four-Star Conference: Initial BCT Charter Operational and Organizational concept, 10-11 January 2000.

United States Transportation Command (USTRANSCOM). “Interim Brigade Combat Team Air Mobility Deployment Analysis.” Briefing to DCINC, 20 Aug 2001.

Vick, Alan et al., *The Stryker Brigade Combat Team: Rethinking Strategic Responsiveness and Assessing Deployment Options*. Santa Monica Calif.: RAND, 2002.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

1. REPORT DATE (DD-MM-YYYY) 27 - 06 - 2003		2. REPORT TYPE Graduate Research Project		3. DATES COVERED (From - To) Jun 2002 - Jun 2003	
4. TITLE AND SUBTITLE Strategic Airlift and the Objective Force Brigade				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Waters, Jeffrey, Major, U.S. Air Force				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Air Force Institute of Technology Graduate School of Engineering and Management (AFIT/EN) 2950 P Street, Building 640 WPAFB OH 45433-7765				8. PERFORMING ORGANIZATION REPORT NUMBER AFIT/GMO/ENS/03E-15	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Colonel Philip Gick USTRANSCOM J5-S Scott Air Force Base DSN 779-1109				10. SPONSOR/MONITOR'S ACRONYM(S) USTRANSCOM J5-S	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT This paper analyzes the projected intertheater airlift requirements for the U.S. Army Objective Force brigade. The research focuses on analyzing these requirements and comparing them to the projected strategic airlift force structure in 2010 to determine if adequate airlift capability will be available to support the Army goal of deployment anywhere in the world within 96 hours. Background information describing the Army Transformation Program will present a framework for understanding the crucial role of the Objective Force brigade. This paper evaluates information obtained through military transportation organization interviews, articles, presentations, publications, and reports. Primary sources of information were: Air Mobility Command, United States Transportation Command, Defense Technical Information Center (DTIC) documents, and the Boeing Company. The analysis shows that although closure in 96 hours is possible in some cases, adequate strategic airlift capability will not be available to meet the Army goal for all possible worldwide scenarios. The baseline scenario required approximately 58% of available airlift to be allocated in order to successfully meet the 96-hour timeline. This is not a reasonable expectation given historical, current and projected future airlift requirements.					
15. SUBJECT TERMS Airlift requirements for the Objective Force, Army Airlift requirements					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 44	19a. NAME OF RESPONSIBLE PERSON LtCol Stephan P. Brady
a. REPORT U	b. ABSTRACT U	c. THIS PAGE U			19b. TELEPHONE NUMBER (include area code) (937) 255-6565 x4367